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भारतीय मानक

वाणी संचार के लिए माइक्रोफोन एवं ईअरफोन

Indian Standard

MICROPHONES AND EARPHONES FOR SPEECH COMMUNICATIONS

ICS 33.160.50; 17.140.50

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BUREAU OF INDIAN STANDARDS
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NATIONAL FOREWORD

This Indian Standard which is identical with IEC 61842 (2002) 'Microphones and earphones for speech communications' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendations of Acoustics and Recording Sectional Committee and approval of the Electronics and Telecommunications Division Council.

The text of the IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

CROSS REFERENCES

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their places are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 60268-1 Sound system equipment — Part 1 : General	IS 9302 (Part 1) : 1979 Characteristics and methods of measurements for sound system equipment: Part 1 General	Technically equivalent
IEC 60268-4 Sound system equipment — Part 4 : Microphones	IS 9302 (Part 3) : 1981 Characteristics and methods of measurements for sound system equipment: Part 3 Microphones	do
IEC 60268-7 Sound system equipment — Part 7 : Headphones and earphones	IS 9302 (Part 6) : 1986 Characteristics and methods of measurements for sound system equipment: Part 6 Headphones and head sets	do

The Technical Committee responsible for the preparation of this standard has reviewed the provisions of the following International Standards and has decided that these are acceptable for use in conjunction with this standard.

IEC 60318-1	Electroacoustics — Simulators of human head and ear — Part 1 : Ear simulator for the calibration of supra-aural earphones
IEC 60603-11	Connectors for frequencies below 3 Mhz for use with printed boards — Part 11 : Detail specification for concentric connectors (dimensions for free connectors and fixed connectors)
IEC 60711	Occluded-ear simulator for the measurement of earphones coupled to the ear by ear inserts
IEC 61094-1	Measurement microphones — Part 1 : Specifications for laboratory standard microphones
IEC 61094-4	Measurement microphones — Part 4 : Specifications for working standard microphones
ITU-T P.51	Artificial mouth
ITU-T P.370	Coupling hearing aids to telephone sets

Indian Standard

MICROPHONES AND EARPHONES FOR SPEECH COMMUNICATIONS

1 Scope

This standard applies to the microphone part and earphone part of handsets, headsets or earsets for speech communications, and also to the microphone units and earphone units of built-in handsets, headsets or earsets. The object of this standard is to establish definitions relating to these electroacoustic transducers, and to standardize the characteristics to be specified and the relevant methods of measurement. This does not exclude the use of other methods of measurement which can be shown to give the same or more reliable results.

2 Normative references

The following reference documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60268-1:1985, *Sound system equipment – Part 1: General*

IEC 60268-4, *Sound system equipment – Part 4: Microphones*

IEC 60268-7, *Sound system equipment – Part 7: Headphones and earphones*

IEC 60318-1, *Electroacoustics – Simulators of human head and ear – Part 1: Ear simulator for the calibration of supra-aural earphones*

IEC 60603-11:1992, *Connectors for frequencies below 3 MHz for use with printed boards – Part 11: Detail specification for concentric connectors (dimensions for free connectors and fixed connectors)*

IEC 60711, *Occluded-ear simulator for the measurement of earphones coupled to the ear by ear inserts*

IEC 61094-1, *Measurement microphones – Part 1: Specifications for laboratory standard microphones*

IEC 61094-4, *Measurement microphones – Part 4: Specifications for working standard microphones*

ITU-T P.51, *Artificial mouth*

ITU-T P.370, *Coupling hearing aids to telephone sets*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1 Classification

3.1.1
handset
assembly for speech communications, which is a handle including a microphone part and an earphone part suitable to be held by the talker's hand

3.1.2
headset
assembly for speech communications, which consists of a holder to put on the talker's head, one or two earphone parts and a microphone part, so as to keep the talker's hands free

3.1.3
earset
assembly for speech communications, which consists of an earphone part and a microphone part, so as to keep the talker's hands free, without a holder to put on the talker's head

NOTE The distinction between an earset and a headset is as complicated as it is between an earphone and a headphone. Table 1 explains the definitions of earphone, headphone, earset and headset used in this standard.

3.1.4
microphone for speech communications:

a) part of a handset, an earset or a headset, which functions as a microphone (an acousto-electrical transducer)

b) assembly of a microphone unit for speech communications and a case for measurement purposes, including acoustical circuit elements so as to obtain practical frequency characteristics

NOTE 1 A microphone for speech communications is understood to include devices, if any, such as amplifiers or impedance matching transformers up to the output terminals.

NOTE 2 A microphone for speech communications is called merely "microphone", or "microphone part" of a handset, of an earset or of a headset, in Clause 4 of this standard and beyond.

3.1.5
earphone for speech communications

a) part of a handset, an earset or a headset, which functions as an earphone (an electro-acoustic transducer)

b) assembly of an earphone unit for speech communications and a case for measurement purposes, including acoustical circuit elements so as to obtain practical frequency characteristics

NOTE 1 Any component which is intended by the manufacturer as an integral part of the earphone is included during measurements.

NOTE 2 An earphone for speech communications is called merely "earphone", or "earphone part" of a handset, of an earset or of a headset, in Clause 4 of this standard and beyond.

3.1.6
microphone unit for speech communications
acousto-electrical transducer installed in a handset, in an earset or in a headset to pick up the talker's speech in the vicinity of his/her mouth

NOTE The microphone unit for speech communications is called merely a "microphone unit" in Clause 4 of this standard and beyond.

3.1.7
earphone unit for speech communications
electroacoustic transducer installed in a handset, in an earset or in a headset to radiate sound signal in the vicinity of the listener's ear

NOTE The earphone unit for speech communications is called merely an "earphone unit" in Clause 4 of this standard and beyond.

3.1.8
case for unit measurement
case in which a microphone unit or an earphone unit for speech communications is installed for measurement. It includes additional acoustic circuit elements so as to obtain practical frequency characteristics, if necessary

3.2 Devices for measurement

3.2.1
mouthpiece holes
holes bored into the front of the enclosure of a microphone unit for speech communications, to receive the input sound

3.2.2
earcap holes
holes bored into the front of the enclosure of an earphone for speech communications, to radiate the output sound

3.2.3
artificial mouth
sound source for microphone measurement, which can produce the sound field similar to that around an ordinary human mouth

3.2.4
artificial ear
acoustic load for earphone measurement, whose acoustic impedance is similar to that of an ordinary human ear. It includes a microphone for measurement

3.2.5
lip ring
circular ring placed in front of the sound outlet of an artificial mouth for localizing the equivalent lip position

3.2.6
lip plane
outer plane of the lip ring, giving the reference point for finding the measuring position

3.2.7
external d.c. power supply
d.c. power supply for a microphone for speech communications including an amplifier or an electrical impedance converter circuit

3.2.8
additional resistance
electrical resistance for the earphone for speech communications which requires an external resistance for necessary adjustment of characteristics of the device

3.2.9
probe coil
coil for measurement of the external magnetic field of an earphone for speech communications

3.3 Characteristics and performance

3.3.1
sensitivity (V/Pa)
absolute value of the ratio between the open-circuit output voltage from a microphone for speech communications placed at a specified point in the sound field produced by the artificial mouth and the sound pressure in the undisturbed free field at a specified calibration point, the signal frequency being the reference frequency

NOTE Though the specified point for the microphone and the sound pressure calibration point should be identical in general, these points may be different according to this Standard.

3.3.2
sensitivity level (dB)

twenty times the logarithm to base ten of the sensitivity divided by the reference sensitivity (1 V/Pa)

3.3.3
sensitivity to voltage (Pa/V)

absolute value of the ratio between the sound pressure produced by an earphone for speech communications in the artificial ear and the voltage supplied to the earphone, the signal frequency being the reference frequency

3.3.4
sensitivity level to voltage (dB)

twenty times the logarithm with a base of ten of the sensitivity divided by the reference sensitivity (20 μPa/V)

3.3.5
sensitivity to power (Pa^2/W)

absolute value of the ratio between mean square of the sound pressure produced by an earphone for speech communications in the artificial ear and the electrical power supplied to the earphone, the signal frequency being the reference frequency

3.3.6
sensitivity level to power (dB)

ten times the logarithm with a base of ten of the sensitivity to power divided by the reference sensitivity (4×10^{-10} Pa^2/W)

3.3.7
electrical impedance (Ω)

absolute value of the internal impedance measured at the output terminals of a microphone for speech communications or the input terminals of an earphone for speech communications

NOTE The word "electrical" is added in this Standard to distinguish the electrical impedance from the acoustical or the mechanical impedance.

3.3.8
capacitance (nF)

capacitance measured at the input terminal of the earphone for speech communications

NOTE The capacitance is relevant only to earphones including a piezoelectric transducer because an ordinary piezoelectric microphone includes an amplifier.

3.3.9
plane of magnetic field strength measurement

a plane parallel to the earcap reference plane at a distance of 10 mm (see 4.2.7)

4 Characteristics and measuring procedures

4.1 General conditions

IEC 60268-1 applies for the following items:

1) Units and system for measurement: IEC 60268-1, Clause 2.
2) Climatic conditions: IEC 60268-1, Clause 8.
3) Graphical presentation of data: IEC 60268-1, Clause 10.

4.2 Rated conditions

In order to perform measurements correctly and reproducibly, certain basic data, to be specified by manufacturer, are essential, and these are termed 'rated conditions'. For a full explanation of rated conditions, see IEC 60268-2.

4.2.1 Rated d.c. power supply voltage (V)

The d.c. power supply voltage for the microphone for speech communications.

4.2.2 Rated sinusoidal voltage (V)

The sinusoidal input voltage over the specified frequency range, under which the earphone for speech communications can operate in a linear mode continuously without any thermal or mechanical damage for a long time.

4.2.3 Rated sinusoidal power (W)

Electric power given by,

$$(U_s)^2 / Z_r$$

where

U_s is the rated sinusoidal voltage;

Z_r is the rated impedance.

4.2.4 Rated noise voltage (V)

The pink noise input voltage over the specified frequency range, under which the earphone for speech communications can operate in a linear mode continuously without permanent damage for a long time.

4.2.5 Rated noise power (W)

Electric power given by,

$$(U_n)^2 / Z_r$$

where

U_n is the rated noise voltage;

Z_r is the rated impedance.

4.2.6 Rated frequency range

Frequency range of a continuous input signal for a normal operation of a microphone or an earphone for speech communications.

4.2.7 Earcap reference plane

Plane formed by the contacting points of a flat surface against the earcap of a handset, an earset or a headset, or by the front plane of the case for earphone unit measurement.

NOTE Partly similar to the definition in ITU-T P.10 (see Bibliography).

4.2.8 Earcap reference point

Point in the earcap reference plane, used as a reference parameter.

NOTE See the note to 4.2.7.

4.2.9 Rated impedance (Ω)

Absolute value of the electrical impedance of a microphone or earphone for speech communications.

For an earphone with an electrodynamic transducer, it is recommended that the value is chosen so that the lowest value of the modulus of the actual impedance within the rated frequency range is not less than 80 % of the chosen value. Alternatively, it may be given as the value at the reference frequency or the value at the frequency specified by the manufacturer.

4.2.10 Rated capacitance (nF)

The capacitance of an earphone for speech communications at the frequency specified by the manufacturer, or at 120 Hz, if not specified.

4.3 Measuring conditions

4.3.1 Environmental interference

The level of disturbances due to environmental noise, reverberation, wind noise, electromagnetically induced noise, vibration noise and other interference shall be at least 10 dB below the measured quantity.

4.3.2 Reference sound pressure

The reference sound pressure for a microphone shall be 1 Pa and that for an earphone shall be 20 μPa.

4.3.3 Signal for measurement

A sinusoidal signal shall be used for measurement unless otherwise specified.

Results may also be gained from measurements using noise signals, quasi-random sequence signals or impulsive signals. If signals other than sinusoidal signals are used, it is the responsibility of the test house to show that the results are equivalent or have fewer artefacts than those obtained with sinusoidal signals.

4.3.4 Reference frequency and frequency range

The reference frequency shall be 1 kHz. The frequency range shall be from 150 Hz to 5 kHz unless otherwise specified. The frequency values for measurement at discrete frequency points shall be specified by the manufacturer.

4.3.5 Apparatus for acoustic measurement

The following apparatus shall be used.

a) Microphone for measurement

   A condenser microphone conforming to IEC 61094-1 or IEC 61094-4 shall be used. Type LS2P or equivalent, or smaller than LS2P, is recommended. A pressure microphone whose sensitivity was calibrated by using the standard condenser microphone is acceptable.

b) Artificial mouth

   The artificial mouth defined by ITU-T Recommendation P.51 shall be used.

c) Artificial ear

   The artificial ear defined in IEC 60318-1 or IEC 60711 shall be used. Additional components shall be used, if necessary.

The type of artificial ear to be used, and conditions relating to shape, dimension or other characteristics of the additional components shall be specified by the manufacturer. In particular, the following items shall be specified clearly.

1) Position of the earcap reference plane,
2) Position of the earcap reference point, and,
3) Direction of axis of the microphone part.

The artificial ear specified in IEC 60318-1, or an artificial ear with a construction as shown in Figure 1, is recommended for measurement of the supra-aural earphone, defined in the Clause 1 of IEC 60268-7: with minimized leakage, mainly for measurements at less than 3.4 kHz.

NOTE 1 The positions of the earcap reference plane and the earcap reference point may be different for a different handset, headset or earset to be measured, even if the same artificial ear is used.

NOTE 2 Only the P type microphone is suitable for use in the artificial ear.

NOTE 3 Recent developments in ITU-T describe the use of head and torso simulator (HATS) for the measurement of communication devices. The relevant Recommendations are ITU-T P.58, ITU-T P.57 and ITU-T P.64. A measurement equipment according to these recommendations can be used alternatively. The chosen test configuration shall be described unambiguously in the test report as well as the exact positioning of the device under test.

4.3.6 Apparatus for electrical measurement

The following instruments shall be used.

a) Automatic frequency response recorder

   Interruption of the signal frequency trace at any instant during the measurement shall affect the indicated response by less than 1 dB.

b) Sinusoidal signal generator and amplifier

   The amplifier associated with the sinusoidal signal generator shall conform to the following requirements:

   1) The total harmonic distortion of the signal applied to the artificial mouth for radiation of the output sound pressure of 1 Pa under the calibration condition (see 4.3) shall be less than 0,1 %.
   2) Earphone to be measured, or the earphone with the necessary additional resistance, shall be less than 0,1 %.
   3) The output level across the rated pure resistance load of the amplifier shall not differ by more than 1 dB from the output level across a load of ten times the rated resistance.

4.3.7 Cases for unit measurement

The acoustical performance of a microphone or earphone unit is often strongly dependent on the mechanical and acoustical properties of the housing in which it is to be operated. Therefore, the microphone/earphone unit to be measured shall be installed in a case for unit measurement unless otherwise specified. An example of a case for microphone unit measurement is shown in Figure 2, and a case for earphone unit measurement in Figure 3.

NOTE The case for unit measurement should be specified for measurement with sufficient reproducibility under conditions similar to actual use. The manufacturer is recommended to specify clearly the following conditions relating to the shape, dimensions or other characteristics which may affect the measuring result:

a) mouthpiece holes or earcap holes,
b) front cavity,
c) front construction of the case,
d) rear construction of the case, and,
e) rear cavity.

4.3.8 Positioning of microphone for measurement and arrangement of apparatus

The relative position of the microphone to be measured and the artificial mouth shall be one of the following. The report of results shall include which position is used.

a) Position determined by the earphone part:

The microphone position given when the earcap reference plane and the earcap reference point of the handset, earset or headset are set at the position of the earcap reference plane and the earcap reference point given by the artificial mouth position. See X-X plane and point O in Figure 4.

NOTE Partly similar to the definition in ITU-T Recommendation P.64. (see Bibliography).

b) Coaxial positioning:

The microphone to be measured and the artificial mouth are set coaxially, and the position of the intersection of axis and front surface of the microphone to be measured is set on the axis of the artificial mouth at the point distant by 25 mm from the lip plane. The axis direction of the microphone can be varied according to the manufacturer's specification.

c) The point specified by the manufacturer.

4.3.9 Probe coil for measurement of external magnetic field

The specification of ITU-T P.370 shall apply.

4.4 Microphones for speech communications

4.4.1 Conditions for measurements

The following conditions shall apply for the measurement and specification of the characteristics of the microphone.

a) The rated d.c. power supply voltage shall be applied for the measurement of the microphone including the amplifier or the electrical impedance transformer.

b) Before the measurement, the output sound pressure of the artificial mouth at the point where the microphone is placed shall be calibrated under the sinusoidal input signal using the construction shown in Figure 5. The input voltage to the artificial mouth shall be adjusted so that the sound pressure at the point distant by 25 mm from the lip plane, on the axis perpendicular to the lip plane through the geometrical centre of the artificial mouth, is the specified measuring sound pressure value.

c) The output sound pressure during the input signal frequency tracing shall be controlled so as to be constant.

d) The measurement microphone for calibration shall be set sideways to the artificial mouth, as illustrated in Figure 5.

4.4.2 Sensitivity level

The microphone sensitivity level shall be measured using the system shown in Figure 6. The microphone to be measured shall be placed at the specified point. The sensitivity level of the microphone is obtained from the measured open-circuit voltage produced by the input sound pressure at the reference frequency or at the frequency specified by the manufacturer, using the following formula;

$$S_T = 20\log_{10}(U/U_0) - 20\log_{10}(p/p_{m0}) \quad \text{dB}$$

where

S_T is the sensitivity level of the microphone to be measured

U is the measured open-circuit voltage, in V

U_0 is the reference voltage, 1 V

p is the measuring sound pressure, in Pa

p_{m0} is the reference sound pressure for microphone, 1 Pa

The recommended measuring sound pressure is the reference sound pressure (see 4.3.2). If the microphone shows non-linear behaviour at the reference sound pressure, a lower measuring sound pressure shall be used. A specified value other than the reference sound pressure shall be clearly stated in the data.

4.4.3 Frequency response

The frequency response of the microphone to be measured should be given by a frequency sweep measurement of the open-circuit voltage with sinusoidal input signal of constant sound pressure, produced by an artificial mouth. A sweep from lower to higher frequency is recommended when the direction of sweep affects the result.

The frequency response may also be measured using a signal other than sinusoidal, described in 4.3.3. When using a signal other than a sinusoidal signal, the amplitude spectrum of the measurement signal shall be selected to be in accordance with 4.3.1.

The measuring system is the same as shown in Figure 6, except that the voltmeter can be replaced by an automatic frequency response recorder or by a computerized measurement system.

To demonstrate the operation in linear mode, two consecutive measurements of the same transfer function of one of the systems shown in Figure 6 shall be made, one with the reference sound pressure level as described in 4.3.2 and the other with a 6 dB lower sound pressure level. The system is regarded as operating in a linear mode if the two resulting amplitude frequency responses show no larger difference than 0,2 dB, in absolute value. If this condition is not fulfilled, a lower measuring sound pressure shall be specified, for which the procedure as described above shows linear operation.

Other items shall be the same as in 4.4.2.

4.4.4 Electrical impedance

The electrical impedance of a microphone unit and of a handset, a headset or an earset with audio frequency output terminals shall be measured.

The methods of measurement of electrical impedance are given in IEC 60268-4.

4.4.5 Listening test for normal operation

This is a simple test. As shown in a) or b) of Figure 7, an abnormal tone during operation of the microphone to be tested shall be detected by listening to the output signal with human speech sound input.

The artificial mouth or other sound source can be used instead of human speech and a case for unit measurement other than that specified can be used when it does not cause an appreciable problem.

When a loudspeaker is used for listening, the listening position shall be at a point convenient to distinguish an abnormal tone, at a distance more than 0,3 m from the reference point of the loudspeaker.

4.5 Earphones for speech communications

4.5.1 Conditions for measurement

The following conditions shall apply for the measurement and specification of the characteristics of the earphone or the earphone with additional resistance, which are called 'earphone to be measured' in this clause. When the additional resistance is used, the resistance value and the manner of connection shall be specified.

Earphones including a coil to generate a magnetic field which is not separable or not able to be short-circuited shall be measured together with the coil, and it shall be noted in the presentation of the results that the result is affected by the coil.

4.5.2 Sensitivity level to voltage

The earphone sensitivity level shall be measured using the system shown in Figure 8. The front of the earphone to be measured shall be placed in close contact with the open front of the artificial ear and the earphone to be measured is fed with the rated sinusoidal voltage at the reference frequency or at the frequency specified by the manufacturer. The sensitivity level to voltage of the earphone to be measured is obtained from the measured sound pressure in the artificial ear using the following formula;

$$S_R = 20\log_{10}(p / p_{e0}) - 20\log_{10}(U_s / U_0) \quad \text{dB}$$

where

S_R is the sensitivity level to voltage of the earphone to be measured

p is the measured sound pressure, in Pa

p_{e0} is the reference sound pressure for earphone, 20 μPa

U_s is the rated sinusoidal voltage, in V

U_0 is the reference voltage, 1 V

NOTE 1 Leakage due to the gap between the earphone and the artificial ear should be controlled so as to be avoided or to be reproducible.

NOTE 2 An earphone with any steep response peaks should be measured at several frequencies.

4.5.3 Sensitivity level to power

The sensitivity level to power of the earphone to be measured shall be calculated using the following formula, from the output sound pressure produced by the rated sinusoidal voltage input at the reference frequency or at the frequency specified by the manufacturer, using the system shown in Figure 8.

$$S_p = 10\log_{10}((p)^2 /(p_{e0})^2) - 10\log_{10}(P_s / P_0) \quad \text{dB}$$

where

S_p is the sensitivity level to power of the earphone to be measured

p is the measured sound pressure, in Pa

p_{e0} is the reference sound pressure for earphone, 20 μPa

P_s is the rated sinusoidal power, in W

The sensitivity to power is relevant to the electrodynamic or the electromagnetic earphones.

NOTE See the notes to 4.5.2.

4.5.4 Frequency response

One of the following methods shall be applied.

a) The frequency response of the earphone to be measured is given by a frequency sweep measurement of the sound pressure in an artificial ear with the rated sinusoidal input. A sweep from lower to higher frequency is recommended when the direction of sweep affects the result.

   The measuring system is the same as shown in Figure 8 except that the voltmeter may be replaced by an automatic frequency response recorder or by a computerized measurement system.

   Other items shall be the same as in 4.5.2 or 4.5.3.

b) The frequency response of the earphone to be measured should be given by a frequency sweep measurement of the sound pressure in an artificial ear with the constant voltage input given by:

$$(P_n Z_r)^{1/2}$$

   where

   P_n is the rated sinusoidal power

   Z_r is the rated impedance

This method is relevant to electrodynamic and electromagnetic earphones.

Frequency response may also be measured using a signal other than sinusoidal, as described in 4.3.3. When using a signal other than sinusoidal, the amplitude spectrum of the measurement signal shall be selected to be in accordance with 4.3.1.

To demonstrate the operation in linear mode, two consecutive measurements of the same transfer function of one of the systems shown in Figure 8 shall be made, one with the input sinusoidal voltage specified above and the other with a 6 dB lower voltage. The system is regarded as operating in a linear mode if the two resulting amplitude frequency responses show no larger difference than 0,2 dB, in absolute value. If this condition is not fulfilled a lower input voltage shall specified, for which the procedure as described above shows linear operation.

4.5.5 Electrical impedance

The electrical impedance of an earphone unit and of a handset or earset with audio frequency input terminals shall be measured. The measuring frequency range shall be the rated frequency range or the frequency range specified by the manufacturer.

Other methods of electrical impedance measurement are given in IEC 60268-7.

4.5.6 Capacitance

The capacitance of a piezoelectric earphone shall be measured at a frequency specified by the manufacturer, or at 120 Hz, if not specified.

4.5.7 Listening test for normal operation

This is a simple test. As shown in Figure 9, normal operation of the earphone to be measured shall be checked by listening to the output sound with human speech signal input whose level is nearby the same as the rated sinusoidal voltage level.

A case for unit measurement other than that specified can be used when it does not cause an appreciable problem.

NOTE The input level should be decreased when the output sound is too loud for human ear.

4.5.8 Rattle test

This is a simple test. Normal operation of the earphone to be measured shall be checked by listening to the output sound with the rated sinusoidal voltage input whose frequency is varied, using the system shown in Figure 9.

Other items shall be the same as in 4.5.7.

NOTE See the note to 4.5.7

4.5.9 External magnetic field strength of an earphone

The method specified in ITU-T P.370 shall apply, except that the measuring surface shall be the plane of magnetic field strength measurement defined in 3.3.9.

5 Connectors and contact designation

The following connectors (plugs and jacks) and the contact designations shall be used for removable interconnection of the end of handset, headset or earset cord and the main equipment.

5.1 Miniature 4-position connector

The plug part of the miniature 4-position connector with 4 contacts, attached at the end of the cord, shall be used. Examples of the plug and jack are shown in Annex A.

The contact designation in Figure 10 is recommended. Contact 1 is recommended to be the negative pole when the included microphone unit requires d.c. voltage feeding.

5.2 Concentric connector

One of the following plugs specified in IEC 60603-11, attached at the end of the cord, shall be used.

Miniature 3.5 mm pin connector (plug) with three contacts (tip, ring and sleeve).

Alternatively, a sub-miniature 2,5 mm concentric connector (plug) similar to that specified in IEC 60603-11, but, with three contacts (tip, ring and sleeve) may be used. An example of the plug is shown in annex B.

The following contact designation is recommended.

Tip: Microphone.
Ring: Earphone.
Sleeve: Common ground.

6 Endurance of insulation

Endurance of insulation between the electrical terminals and the exposed metal parts (except the electrical terminals) of the handset, the headset or the earset shall be 250 V a.c. and 1 min or longer.

7 Characteristics to be specified

The items shown in Table 2 for microphones or Table 3 for earphones shall be specified.

Table 1 – Definitions of earphone, headphone, earset and headset

	Number of earphone units	Holder (headband, for example)	Microphone
Earphone	1	no	no
Headphone	1	yes	no
Headphone	2	no	no
Headphone	2	yes	no
Earset	1	no	yes
Headset	1	yes	yes
Headset	2	no	yes
Headset	2	yes	yes

Table 2 – Characteristics of microphones for speech communication to be specified and classification

Data which shall be given by the manufacturer are indicated by an "X" in the tables below. Data which the manufacturer is recommended to give are indicated by the letter "R".

A = Data which shall be labelled on the equipment.

B = Data which shall be specified in a document available to the user before purchase of the equipment.

(U) = For units only.

(S) = Not for units.

If more than one "X" is given, the data shall be given in both cases.

Characteristic	A	B	Clause/subclause
Rated d.c. power supply voltage*		X	4.2.1
Rated frequency range		X	4.2.6
Rated impedance		X	4.2.9
Case for unit measurement		X(U)	3.1.8 and 4.2.7
External d.c. power supply condition*		X	3.2.7
Sensitivity		R	3.3.1
Sensitivity level		X	3.3.2
Frequency response		X	4.3.4
Connectors		X	5
Contact designation	R	X	5
Name of manufacturer	R(U), X(S)**	X	
Product code		X	
Data on shape, construction and size		X	
Electrical connections for power supply*		X	

* Applied to a microphone requiring an external d.c. power supply.

** Symbol or trade mark is acceptable.

Table 3 – Characteristics of earphones for speech communication to be specified and classification

See Table 2 for the key to the symbols used in the table except that:

(M) = For electromagnetic or electrodynamic earphones only.

(P) = For piezoelectric earphones only.

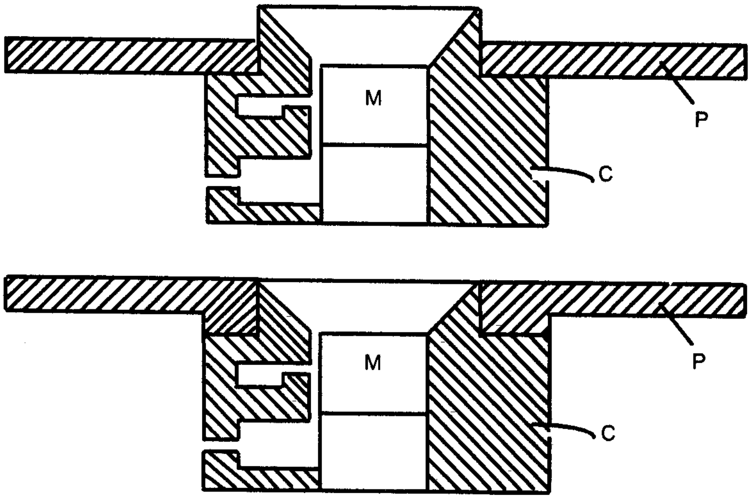
Characteristic	A	B	Clause/subclause
Rated sinusoidal voltage		X(P)	4.2.2
Rated sinusoidal voltage or power		X(M)	4.2.2 or 4.2.3
Rated noise voltage		X(P)	4.2.4
Rated noise voltage or power		X(M)	4.2.4 or 4.2.5
Rated frequency range		X	4.2.6
Earcap reference plane		X(S)	4.2.7
Earcap reference point		X(S)	4.2.8
Rated impedance		X(M)	4.2.9
Rated capacitance		X(P)	4.2.10
Case for unit measurement		X(U)	3.1.8 and 4.2.7
Additional resistance*		X	3.2.8
Probe coil**		X	3.2.9
Sensitivity to voltage		R	3.3.3
Sensitivity level to voltage		X(P), R(M)	3.3.4
Sensitivity to power		R(M)	3.3.5
Sensitivity level to power		X(M)	3.3.6
Frequency response		X	4.4.3
External magnetic field strength of an earphone**		R	4.5.9
Connectors		X	5
Contact designation	R	X	5
Name of manufacturer	R(U), X(S)***	X	
Product code		X	
Data on shape, construction and size		X	
Electrical connections for power supply****		X	

* Applied to an earphone requiring an additional resistance.

** Applied to an earphone for which the external magnetic field is specified.

*** Symbol or trade mark is acceptable.

**** Applied to an earphone which requires an additional power supply.



Key

M Microphone for measurement

C Artificial ear specified by IEC 60318

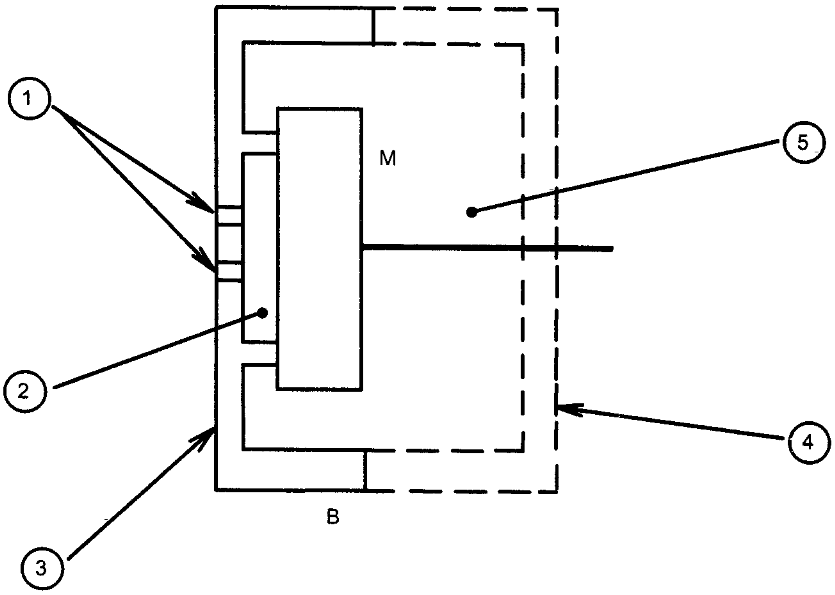
P Additional circular plate, of rigid and non-magnetic material

NOTE 1 The earphone to be measured shall be applied to the plate P in such a way as to minimize leakage as far as possible. This condition determines the earcap reference plane.

NOTE 2 Unless otherwise stated clearly with the results, the earcap reference point shall be on the axis of the artificial ear.

NOTE 3 The position of the microphone part is arbitrary.

Figure 1 – Artificial ear for ordinary earphones



Key

M Microphone unit to be measured

B Case for unit measurement

① Mouthpiece holes

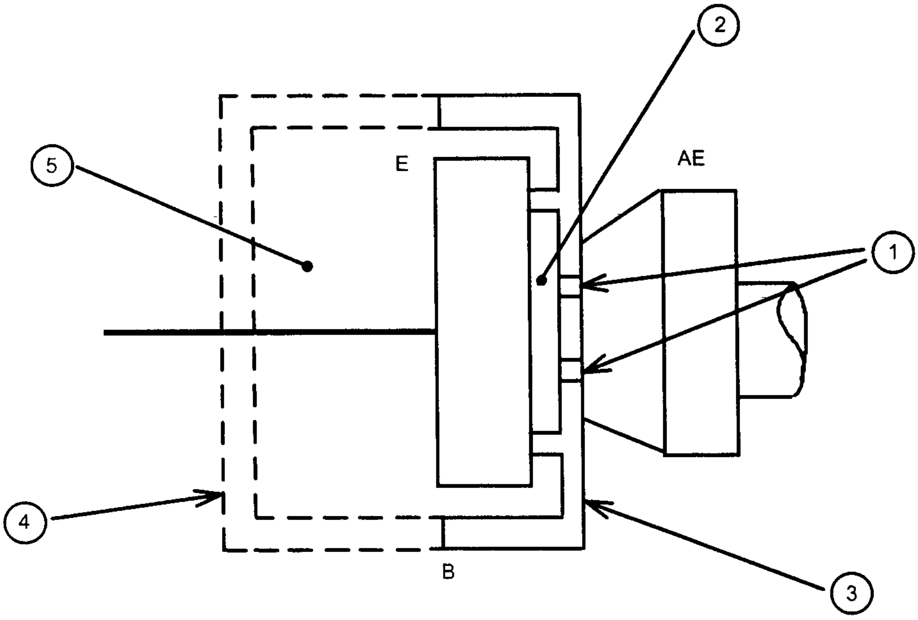
② Front cavity

③ Front of the case

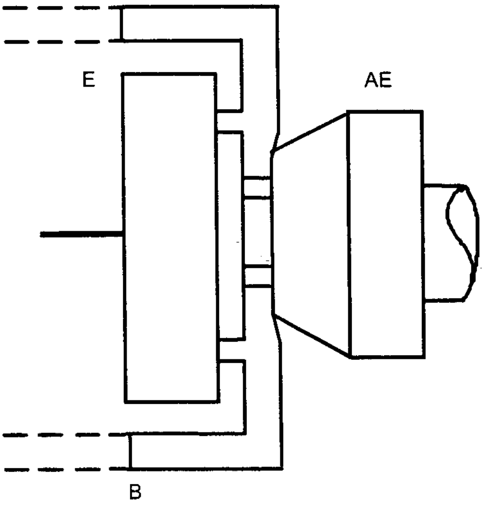
④ Rear of the case

⑤ Rear cavity

Figure 2 – Example of the case for microphone unit measurement



a)

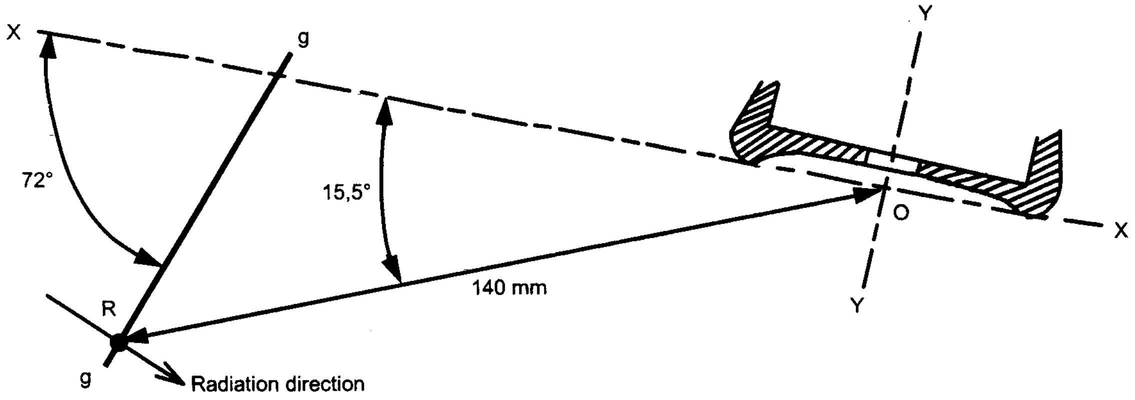


b)

Key

E	Earphone to be measured
B	Case for unit measurement
AE	Artificial ear
①	Earcap holes
②	Front cavity
③	Front of the case
④	Rear of the case
⑤	Rear cavity

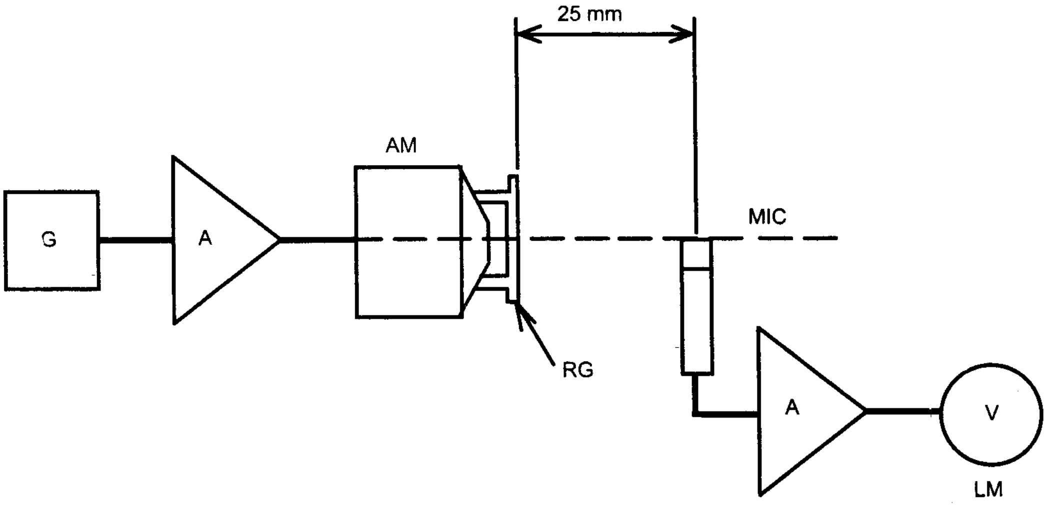
Figure 3 – Example of the case for earphone unit measurement



Key

X-X	Earcap reference plane (perpendicular to surface of this diagram)
O	Earcap reference point
R	Position of lip ring centre of the artificial mouth
g-g	Lip plane of the artificial mouth (perpendicular to the surface of this diagram)

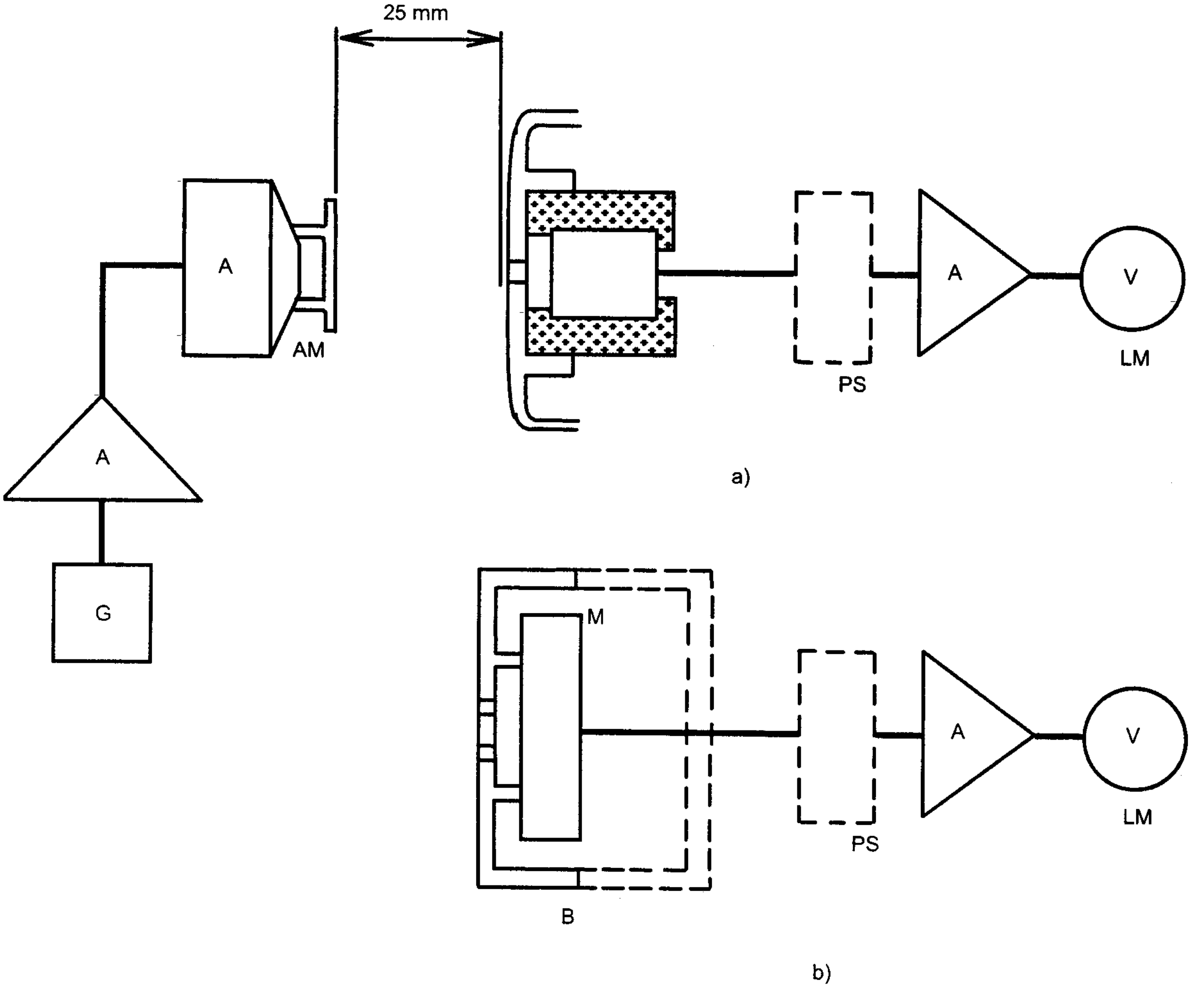
Figure 4 – Determination of the artificial mouth position from the earcap reference point



Key

G	Sinusoidal signal generator
A	Amplifier
AM	Artificial mouth
RG	Lip ring
MIC	Microphone for measurement
LM	Level meter

Figure 5 – Calibration system diagram for output sound pressure from artificial mouth

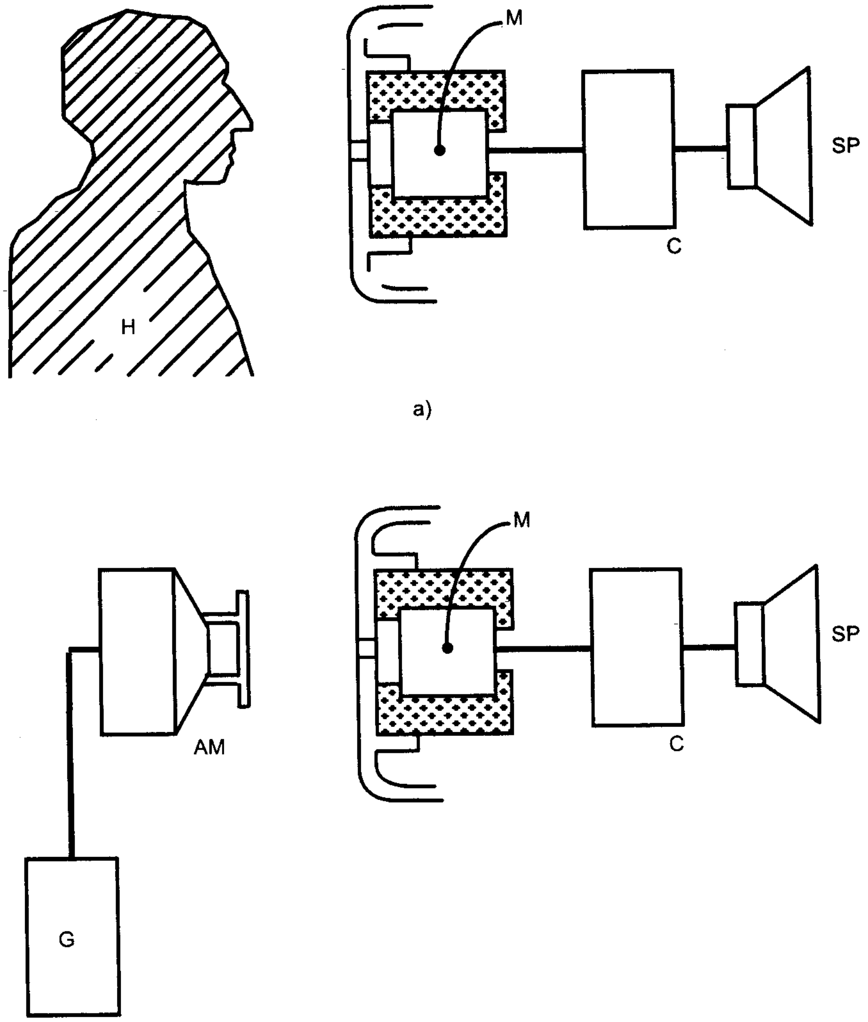


Key

G	Sinusoidal signal generator
A	Amplifier
AM	Artificial mouth, with lip ring
B	Case for unit measurement
M	Microphone unit to be measured
PS	Power supply
LM	Level meter

NOTE Components shown by the dotted line can be omitted.

Figure 6 – Measuring system diagram for microphone unit sensitivity



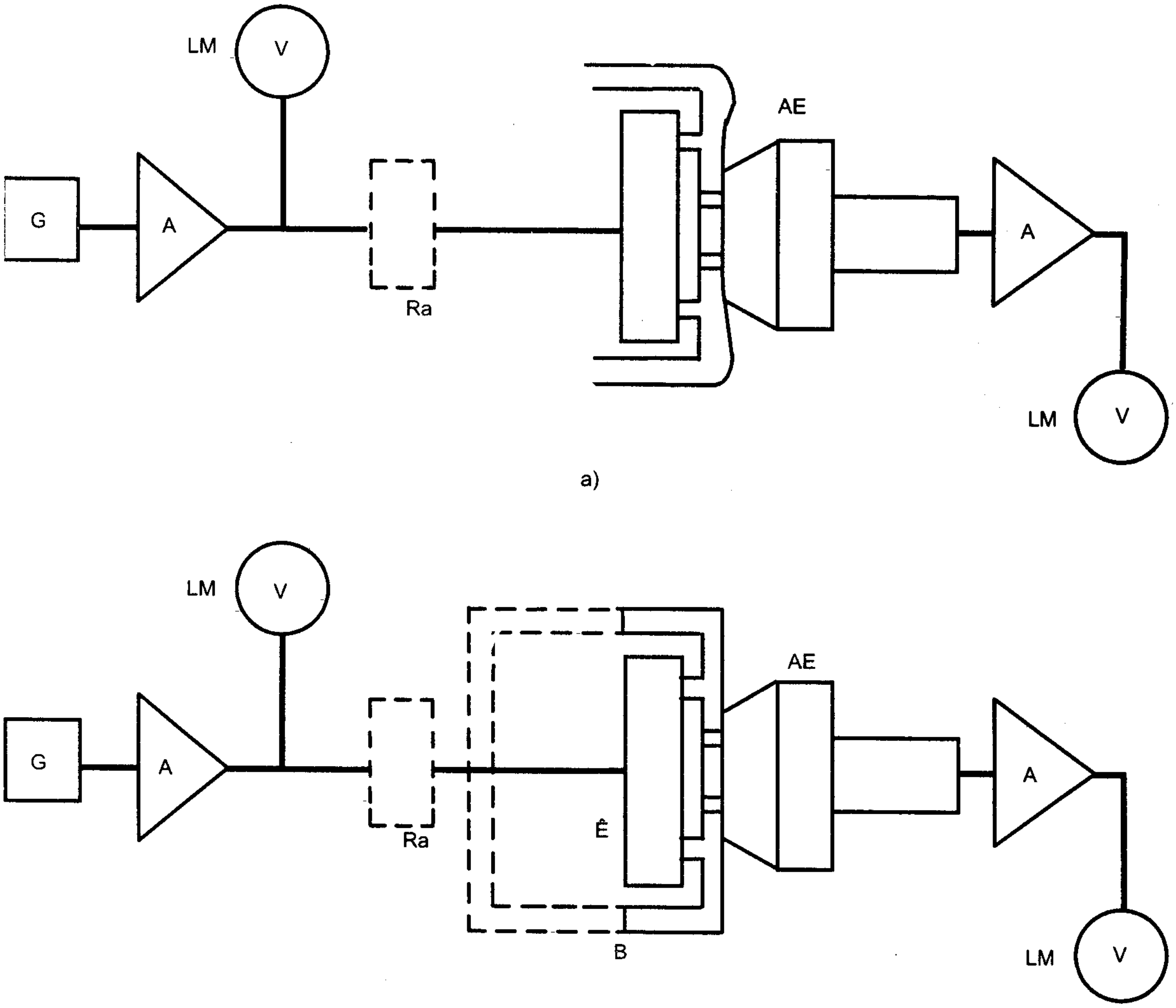
a)

b)

Key

H	Talker
G	Speech signal source
C	Electrical circuit for test
SP	Loudspeaker, earphone or headphone
M	Microphone unit

Figure 7 – Diagram of listening test for normal operation of microphone



a)

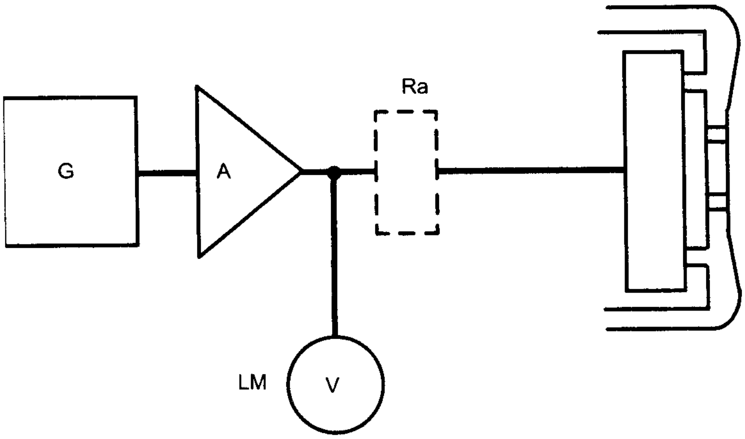
b)

Key

G	Sinusoidal signal generator
A	Amplifier
LM	Level meter
Ra	Additional resistance
B	Case for unit measurement
E	Earphone unit to be measured
AE	Artificial mouth

NOTE Components shown by dotted lines can be omitted.

Figure 8 – Measuring system diagram for earphone sensitivity

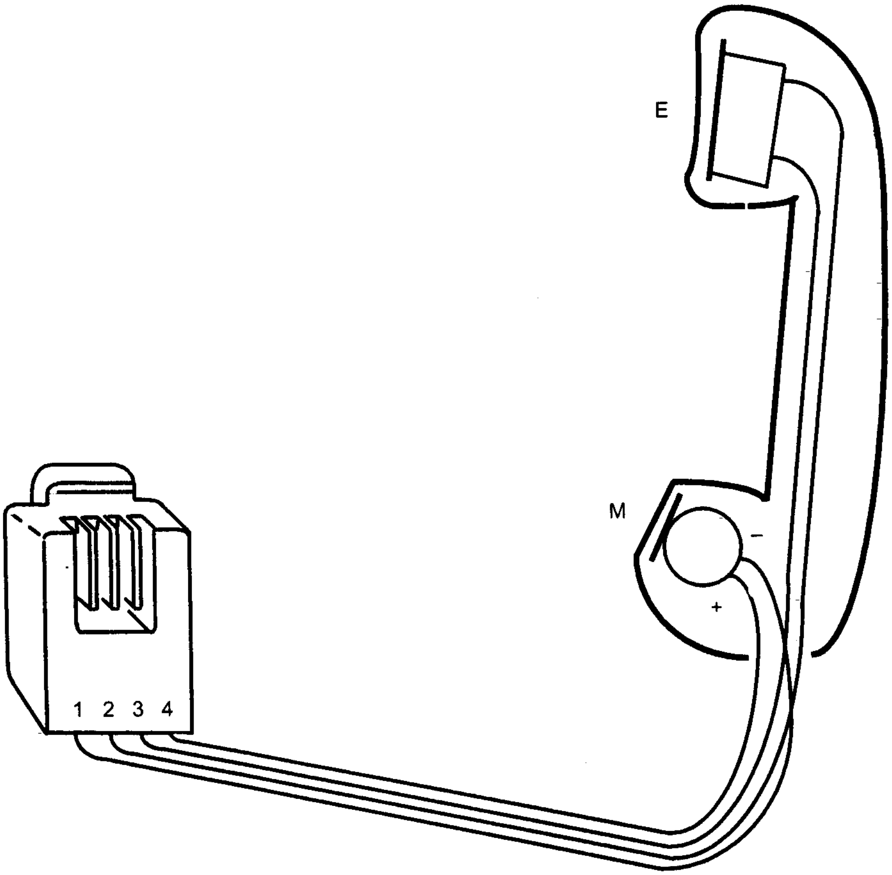


Key

G Speech signal source

Other symbols are the same as in Figure 8.

Figure 9 – Diagram of listening test for normal operation of earphone



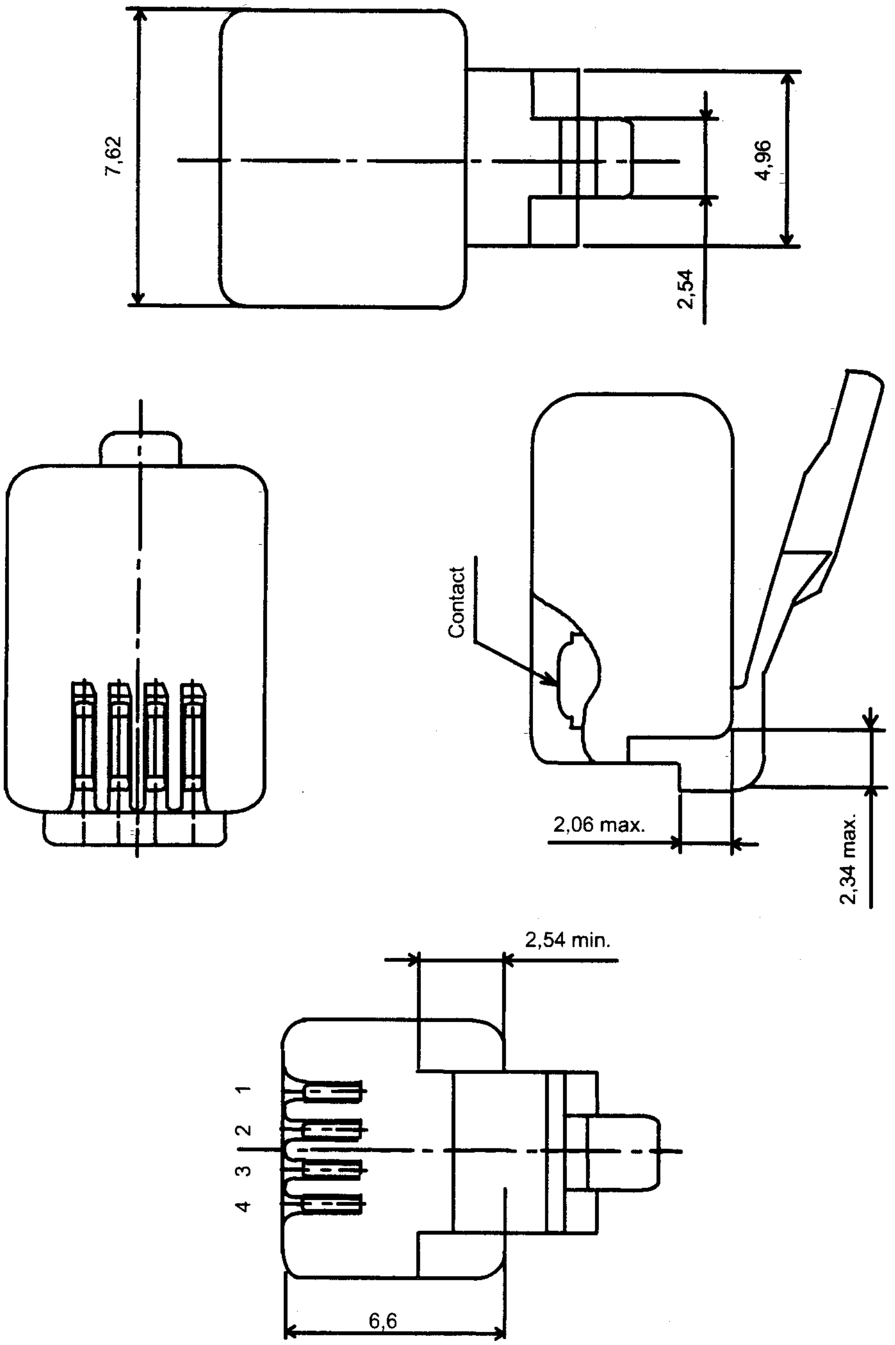
Contact 1:	Microphone, d.c.–
Contact 2:	Earphone
Contact 3:	Earphone
Contact 4:	Microphone, d.c.+
E	Earphone
M	Microphone

Figure 10 – Connection designation for plug of miniature 4-position connector

Annex A
(informative)

Miniature 4-position connector

The plug of the miniature 4-position connector with 4 contacts shown in Figure A.1 shall be used. The shape of the plug interface part of the jack for miniature 4-position connector is illustrated in Figure A.2 for information.



NOTE The dimensions are for identification purposes only.

Figure A.1 – Shape and basic dimensions of plug for miniature 4-position connector

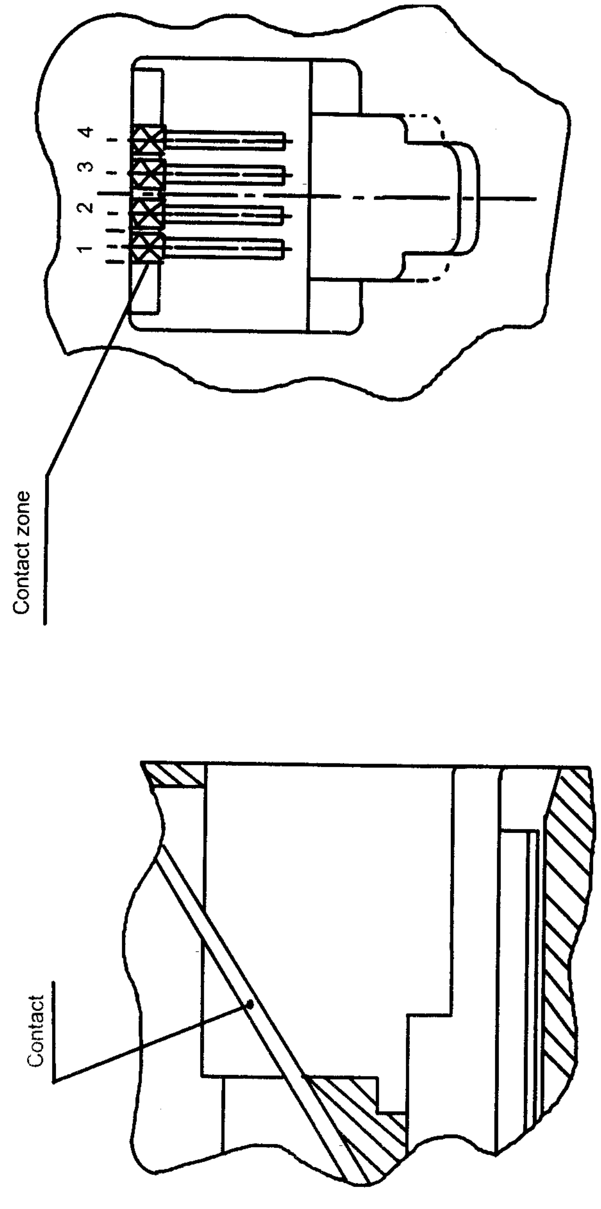


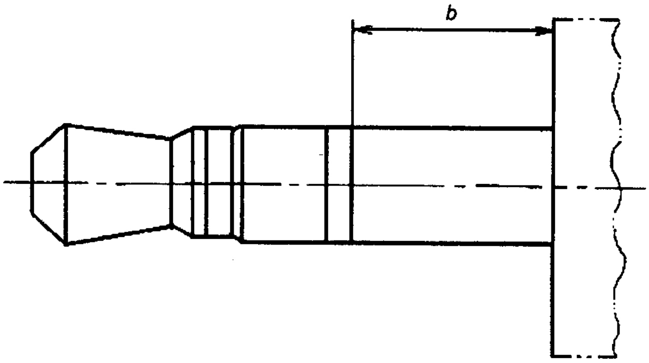
Figure A.2 – Shape of plug interface part of jack for miniature 4-position connector

Annex B

(informative)

Sub-miniature 2,5 mm concentric connector with three contacts

The plug of a 2,5 mm diameter free connector shall be used, similar to that specified in IEC 60603-11 except that it has three poles shall be used, as shown in Figure B.1.



Adaptation from the connector specified in 5.6 of IEC 60603-11.

Length *b* is 4 mm.

Figure B.1 – 2,5 mm pin concentric connector (plug) with three contacts (tip, ring and sleeve)

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